DOCUMENT RESUME

ED 306 922 HE 022 648

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TITLE A Model Program for Preparing Middle School Mathematics Teachers.
INSTITUTION American Association of State Colleges and Universities, Washington, D.C.; Illinois State Univ., Normal. Dept. of Mathematics.
SPONS AGENCY National Science Foundation, Washington, D.C.
PUB DATE 15 Jan 89
GRANT TEI-8652037
NOTE 17p.; This report is one of a group gathered by the AASCU/ERIC Model Programs Inventory Project, funded by the Fund for the Improvement of Postsecondary Education to the American Association of State Colleges and Universities, in collaboration with the ERIC Clearinghouse on Higher Education. For related documents, see HE 022 565-617, HE 022 619-643 and HE 022 645-659.
PUB TYPE Reports - Descriptive (141)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Higher Education; *Mathematics Teachers; Models; *Preservice Teacher Education; Program Descriptions; *Secondary School Teachers; State Universities; Teacher Education Programs; Teacher Improvement; Undergraduate Study
IDENTIFIERS *AASCU ERIC Model Programs Inventory Project; *Illinois State University

ABSTRACT

The Illinois State University Model Middle School Mathematics Program (MSMP) described in this report is an undergraduate program designed to prepare middle school mathematics teachers. Its goals include: providing them with a strong background in relevant and updated mathematical content; helping them develop skills in the use of constructivist methods of teaching mathematics; and educating them about current trends and issues in teaching and learning mathematics in general. The MSMP is embedded in a 4-year undergraduate program of studies currently in effect at the university for preparing middle school teachers. It has about 80 students enrolled, and it features a strong mathematics component including course work in geometry, abstract algebra, probability and statistics, basic components of calculus, and mathematical modeling. The coursework also addresses the needs of gifted and underachieving adolescents and the uses of technologies in teaching mathematics. Structured field experiences are interwoven throughout the program, including student teaching. A seminar addressing critical issues (e.g., women and minorities in math and math-related careers in business and industry) is offered concurrently with student teaching. The program is currently being piloted and data are being gathered for the summative evaluation on effectiveness. Two figures show the two components of evaluation design (participants' knowledge and competence and current validity and program impact). (SM)

ED306922

A MODEL PROGRAM FOR PREPARING MIDDLE SCHOOL MATHEMATICS TEACHERS

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funded by
NATIONAL SCIENCE FOUDATION
Grant #TEI - 8652037
JANUARY 15, 1989

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HE 022 648

AASCU/ERIC Model Programs Inventory Project

The AASCU/ERIC Model Programs Inventory is a two-year project seeking to establish and test a model system for collecting and disseminating information on model programs at AASCU-member institutions--375 of the public four-year colleges and universities in the United States.

The four objectives of the project are:

- To increase the information on model programs available to all institutions through the ERIC system
- To encourage the use of the ERIC system by AASCU institutions
- To improve AASCU's ability to know about, and share information on, activities at member institutions, and
- To test a model for collaboration with ERIC that other national organizations might adopt.

The AASCU/ERIC Model Programs Inventory Project is funded with a grant from the Fund for the Improvement of Postsecondary Education to the American Association of State Colleges and Universities, in collaboration with the ERIC Clearinghouse on Higher Education at The George Washington University.

ABSTRACT

The Illinois State University Model Middle School Mathematics Program (MSMP) is an undergraduate program for the preparation of middle school mathematics teachers developed under a five-year grant from the National Science Foundation. The NSF-funded project for the development, implementation and evaluation of the MSMP is currently in its third year of funding. The program has been designed through the cooperative efforts of mathematicians and mathematics educators at Illinois State University, and exemplary middle school mathematics teachers in the Central Illinois area.

The program features a strong mathematics component, including course work in geometry, abstract algebra, probability and statistics,basic concepts of calculus, and mathematical modeling. In addition to a general mathematics methods course on the teaching of middle school mathematics, the coursework also addresses the needs of gifted and underachieving adolescents, and the uses of technologies in teaching mathematics. Structured field experiences are interwoven throughout the program, including student teaching. A seminar addressing critical issues such as the participation of women and minorities in mathematics, math-related careers in business and industry, and others, is offered concurrently with student teaching.Three follow-up sessions are held for program graduates during their first year of teaching.

The program is currently being piloted and data are being gathered for the summative evaluation on the effectiveness of the program as well as for formative purposes. There are approximately 80 students enrolled in the MSMP at present.

INTRODUCTION and BACKGROUND

During the last decade we have seen the emergence in the United States of the middle school with single subject classrooms and teachers. In mathemaitcs, former elementary school teachers or secondary teachers have been reassigned to teach content in these schools. Few, if any, have been specifically trained to do so. Currently very few colleges and universities have programs specifically oriented to the needs of those preparing for middle/junior high school mathematics/science teaching (NSTA, 1982). Yet it is critically important that students at the middle and junior high school levels - early adolescents who often make decisions about whether to pursue or abandon interests in mathematics - be taught by qualified teachers who have received adequate training in mathematics and in the teaching of mathematics at these levels (NSF-1978: NSTA-1983: NCTM-1981). Not only is excellent mathematics teaching necessary for those students who may later elect to pursue careers in mathematics; it is essential for ALL students who must function effectively as citizens in a high technology society.

In an effort to address these needs, the Division of Teacher Preparation and Enhancement of the National Science Foundation awarded grants to nine colleges and universities in 1986 to develop comprehensive model programs for training middle/junior high school mathematics/science teachers. Illinois State University was one of the nine institutions to receive an award.

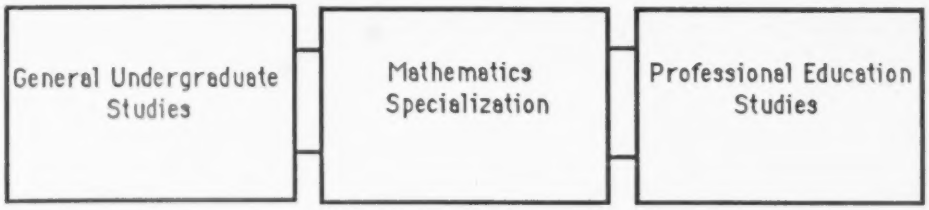
The award to ISU was timely in that the state of Illinois, like many other states, issued in 1985 new certification requirements for teachers taking new middle school positions and those being reassigned to teach mathematics at that level. The requirements call for an increased emphasis on mathematical content and on specific methods for teaching mathematics (Illinois State Board of Education, 1985).

What follows is a description of the ISU MSMP program, including a statement of its philosophy and goals, and a brief annotation of the content courses, mathematics education courses, and professional education courses. Also included is information on the program's admission and graduation requirements and project resources.

DESCRIPTION OF PROGRAM

Program Overview

The MSMP is embedded in a four-year undergraduate program of studies currently in effect at ISU for preparing junior high/middle school teachers. Enrollment in this program has been approximately 110 students per semester. The program can be viewed as consisting of three components, shown below:



Details of the General Undergraduate and Professional Education components are included in Appendix A. The MSMP focuses on the mathematics specialization component of the program. The specialization consists of a mathematics content strand, a mathematics pedagogy strand, and a practicum. The topics in each strand are summarized below:

Mathematics Specialization

Content	Methods	Practicum
Structure of Number Systems	Discovery	Math Mini-Lessons
Number Theory	Exposition	Math Clinic (Diagnostic/Tutorial)
Relations and Functions	Estimation and Mental Arithmetic	Structured Field Experience
Algebraic Structures	Calculators and Computers	Student Teaching
Probability, Statistics, and Mensuration	Problem Solving	
Applications/Problem Solving	Diagnosis and Remediation	
Basic Concepts of Calculus	Enrichment	
Mathematical Modeling	Evaluation	
	Individualization/Grouping	

The content topics have been selected following the standards for the preparation of middle school teachers set by the National Council of Teachers of Mathematics in its Guidelines for the Preparation of Mathematics Teachers (1981) and by the Mathematical Association of America in its Recommendations on the Mathematical Preparation of

Teachers (1983). The methods topics reflect the NCTM's recommendations for mathematics teaching put forth in An Agenda for Action (NCTM, 1980) and in the Curriculum and Evaluation Standards for School Mathematics (NCTM, 1989).

These topics have been organized into courses to be completed in the sophomore, junior, and senior years according to the schedule shown below:

Middle School Model Mathematics Program

Freshman Year	Fall	Identification	Publicity (Academic Advisement) Orientation Meeting	
	Spring	Admission	Math Screening Test Individual Interviews Program Advisement	
		Content Strand	Pedagogical Strand	Practicum
Sophomore Year	Fall	Math Topics for Middle Sch.Teachers (3) (MAT202) Geometry (3) (MAT 204)		Math Mini-lessons Math Mini-lessons
	Spring	Statistics and Probability (3) (MAT 312)	Teaching Middle. School Math with Calculators and Computers (3) (MAT 306)	Math Mini-lessons
Junior Year	Fall	Algebraic Structures for Teachers (3) (MAT 205)	Problem Solving (3) MAT 309	
	Spring	Basic Concepts of Calculus (3) (MAT 314)		
Senior Year	Fall	Mathematical Modeling and Applications (3) (MAT 316)	Mathematics Instruction in the Middle School (3) (MAT 302)	Field Experience
	Spring		Middle School Mathematics Education Seminar (1) (MAT 287)	Student Teaching (12)
Induction Year	Follow-up Sessions and Workshops			

Numbers in parentheses indicate semester hours.

The program includes a set of induction year activities involving program graduates who start teaching the year following graduation. The activities are designed to allow for continued support from program faculty during the participants' first year of teaching. In addition they allow for the collection of follow-up data necessary for program evaluation.

Program Philosophy and Goals

Theoretical Perspective

The model program is based on three premises regarding the learning of mathematics. The first premise is that learning mathematics is a *constructive process*; Dewey and Piaget each based over 50 years of work on this idea. The idea is consistent with much of the current research on mathematical problem solving and with important recent developments in cognitive science (Greeno, 1984). The second premise is that learning mathematics is a *reflective activity*. Essential to learning mathematics are the processes of abstraction, conjecturing, and generalization. All of these processes call for reflective thought on the part of the learner. In this program the learner is viewed as playing a more (mentally) active role than that resulting from a notion of mathematics learning "as tantamount to memorizing mathematical 'facts' or the accretionary building of elaborate sets of behaviors" (P. Thompson, 1984). The third premise is that to learn mathematics is to learn *problem solving*. This is in contrast to the common view that one learns a set of mathematical skills and then learns to apply them to solve problems (e.g., Gagné, 1983).

These three premises will guide the design of course activities and the delivery of instruction in the proposed model program. Underlying this action is the belief that in order to prepare mathematics teachers to teach in a way consistent with these premises, they, themselves, must experience mathematics learning as a constructive process in which they must engage in reflective problem-solving.

Consistent with the underlying premises, the curricular and pedagogical orientation of the program is conceptual as opposed to a skills-development orientation. This is not only true of the content courses, but of the methods courses as well.

Program Goals

The program goal is to prepare prospective teachers of mathematics for the middle school (grades 5-9) by:

a. providing them with a strong background in relevant and updated mathematical content;
b. providing them with knowledge and skills in the use of constructivist methods of teaching mathematics, including the use of appropriate technologies;
c. helping them develop those skills by allowing opportunities to put them into practice in various realistic instructional settings;
d. educating them about current trends and important issues in the teaching and learning of mathematics in general, but particularly at the middle school level.

As part of the effort to develop and implement the model program the project seeks to evaluate and accordingly revise the model program and to develop a complete program manual for dissemination of information, including produced materials.

Program Courses

Content Courses

A brief description of each course follows.

Mathematics Topics for Middle School includes activities for the exploration and analysis of some of the main topics and ideas of the middle school curriculum with emphasis on unifying concepts, properties, patterns, problem-solving heuristics, and inductive and deductive reasoning. It will include the study of finite and infinite number systems from the natural to the real numbers; some concepts and problems from elementary number theory; relations and functions and their graphs; and the basic concepts of consumer mathematics (ratio, proportion, percent, and interest). *(3 semester units)*

Geometry includes activities to help middle school pre-service teachers become actively involved in exploring the ideas of geometry. It includes content and investigation activities (some computerized) that provide an in-depth understanding of the geometry ideas currently suggested for inclusion in the middle school curriculum, such as basic concepts and relations, geometric patterns, properties of polygons and polyhedra, symmetry, constructions, coordinates, tessellations, transformations, topology, networks, and measurement.*(3 semester units)*

Algebraic Structures is designed to build upon the experiences of the geometry course. Based on the background work on symmetry and transformation geometry the concepts of group theory can be introduced. The object is to show the relationship between these aspects of geometry and abstract algebra. The focus of the course is on mathematical structures of an algebraic nature.

Probability and Statistics is designed to provide an introduction to counting principles, and the language and properties of discrete probability, including the main concepts and ideas in theoretical and empirical probability; the computation of simple and compound probabilities (independent and dependent events, binomial probability and complementary probabilities). A set of simulation and application activities (some computerized) are used. In addition, the course it includea the study of concepts in descriptive and inferential statistics such as measures of central tendency, measures of dispersion, randomness, types of distributions, sampling techniques, Monte Carlo techniques, misuses of statistics, and computer applications.*(3 semester units)*

Basic Concepts of Calculus is designed to introduce the basic concepts of differential and integral calculus including limits, continuity, differentiation, and integration. The emphasis is on understanding the concepts and the types of problems addressed in calculus as opposed to the development of proficiency in computational techniques. Software is used extensively to illustrate concepts and solve problems. The use of a computerized algebra system will allow the study of concepts and their applications without the need for computational facility. *(3 semesters units)*

Mathematical Modeling/Applications is designed to familiarize students with a wide variety of applications of mathematics, and to equip them with additional concepts that can be used to model real world situations. An overview of the modeling process, pragmatic issues involved in developing and applying models, and communication of results are presented. Since this course follows both Probability and Statistics and Basic Concepts of Calculus, these concepts are available to the students. Some examples of topics are: (1) Plotting raw data and choosing an appropriate function to approximate the results. Drawing inferences from the resulting model. (2) Conjecturing a form for a model equation, gathering and plotting data, and comparing actual with predicted results. For example, students can be led to conjecture that the weight of a fish of a certain species is proportional to the cube of its length. Data could be gathered and plotted and the goodness of the model discussed. (See Giordano and Weir, 1985, p. 57.) (3) Models using simple finite difference equations can be developed and used to predict interest, population growth, growth of bureaucracies, etc. (4) Euler tours and Hamilton circuits in graphs will be presented and their application to the optimization of city services such as garbage pick-up, snow removal, and water-meter reading can be discussed. (5) Finite Markov chains will be discussed and their applications to weather predictions, grades, etc. *(3 semester units)*

Optional Elective. Students have the option of choosing any one of the following courses already in place: Number Theory, History of Mathematics, and Calculus (recommended for participants who eventually may become interested in seeking senior high certification). *(3 semester units)*

Math Mini-Lessons. The Math Topics, Geometry, and Probability and Statistics courses include a set of pedagogical experiences (math mini-lessons) that the students carry out in middle-grade classrooms at local schools. These experiences consist of teaching specific topics (related to the course content) to small groups of youngsters using appropriate instructional aids. The intent of such experiences is threefold: (1) to enable the program participants to "see" the connection between the content they are studying and that of the middle school mathematics curriculum, (2) to help them appreciate the need for a thorough conceptual understanding of the content on their part in order to teach mathematics effectively; and (3) to expose them early in the program to structured field experiences that will allow them to interact with youngsters in professionally meaningful ways. To attain these purposes the experiences are designed as a package of mini lessons, focusing on appropriate strategies for teaching different types of mathematical content, i.e., concepts, principles, algorithms, problems, and facts. These experiences are part of the requirements of the Math Topics, Geometry, and Probability and Statistics courses and are supervised by the faculty in charge of each course.

Mathematics Education Courses

Teaching Middle School Mathematics with Calculators and Computers is designed to introduce middle school teachers to Logo and its use in exploring basic geometry ideas. It includes a review and evaluation of available software for mathematics instruction with particular emphasis in the use of microworlds. The course also deals with appropriate uses of calculators in teaching mathematics, emphasizing their use in the development of concepts and the discovery of patterns and generalizations. Students are required to complete a computer project as part of the course. *(3 semester units)*

Problem Solving. The course has two components: a content component dealing with solving problems, and a pedagogical component addressing the integration of problem solving into instruction. The first component deals with the development of mathematical thinking in the processes of formulating, solving and extending problems. Emphasis is placed on specializing, inferring patterns, conjecturing, testing conjectures, and generalizing. Plausible reasoning in informal proofs as well as proof by induction and deductive proof are used to prove general solutions to problems. Instructional, classroom organization, and managerial techniques for integrating problem solving into mathematics instruction are presented, including evaluation.

Mathematics Instruction in the Middle School emphasizes instructional methods (with specific strategies) that facilitate youngsters' construction of mathematical concepts, generalizations, relationships, and algorithms. The course stresses the development of mathematical thought processes and general problem-solving skills as the major goal of mathematics instruction. Accordingly, emphasis is given to the use of appropriate questioning techniques to gain insights into youngsters' understandings and misunderstandings. Other topics included are the selection and use of appropriate instructional aids, different modes of individualizing instruction, and the evaluation of students' progress. An innovative feature of this course is the use of *case studies* of teachers as a means to learn about principles, maxims, and norms of mathematics teaching. Shulman (1986) argued that, as used in medical and law schools, case studies may be more effective in helping preservice teachers acquire knowledge of teaching than the more traditional approaches consisting of a series of skills and traits to be mastered and a list of problems and concerns to be resolved. He argued that the relative ineffectiveness of such approaches is due to the fact that such lists

> "become very hard to remember, especially as they aggregate into long lists. . . . Second, they gain their economy precisely because they are decontextualized, stripped down to their essentials, devoid of detail, emotion, or ambience. Yet to be remembered and then wisely used, it is precisely the detail and the context that may be needed." (p. 11)

There are three case studies of experienced middle school teachersused (A. Thompson, 1984). However, these were not specifically designed for the course. Consequently, they are in need of revision as they should be shortened and reorganized.

In addition, six videos of exemplary lessons on key topics of the middle school mathematics curriculum have been produced for use in this course. The topics of the video lessons are: integers, percents, predicting from samples, constants and variables, generalizing from geometric patterns, and descriptive statistics. The lessons exemplify exposition/discussion, guided discovery, and problem solving as instructional approaches in presenting mathematical content. They illustrutate appropriate uses of models or representations in explaining mathematics as well as questioning techniques intended to guide and probe students understanding. The videos were produced by a media expert at the ISU Instructional Media Center in cooperation with some of the program faculty. The videos and viewing guide are available for dissemination.

A field experience consisting of sixty hours (three hours per day for four weeks) of instructionally related activities in a middle school classroom is a requirement of this course.*(3 semester units)*

Middle School Mathematics Education Seminar addresses current trends and issues in mathematics education at the middle school level, and is offered concurrently with Student Teaching. Four issues that have been identified for inclusion are: (1) Career awareness and application of mathematics in business, industry and related fields. Materials from the Equals Project are used for this purpose and speakers from local businesses such as State Farm Insurance Company, General Electric, and Data Processing Management Association are invited. (2) The treatment of girls and minorities in the mathematics classroom. Findings of the research conducted in the USA by Fennema and others is presented and their implications for instruction are discussed. (3) The evaluation of "higher order" thinking processes. (4) Underachievers and learning handicapped in the mathematics classroom. *(1 semester unit)*

Student Teaching. Program participants complete 12 semester hours of student teaching in a middle grade class. The program attempts to place student teachers in the classrooms of exemplary teachers previously identified by their participation in the 1984-85 and 1985-86 NSF-funded ISU Honors Project. A module has been developed with directions for three instructional tasks to be completed during student teaching. The tasks are: (1) to develop and administer a diagnostic test, interpret the children's work, accordingly prescribe and implement appropriate remedial lessons involving the use of manipulatives, and conduct a post assessment; (2) carry out a lesson that makes use of microcomputers to explore a concept or generalization; and (3) design and implement an enrichment lesson. Each student teacher will be supervised and evaluated by the supervising teacher and a program faculty with instruments specially designed for this purpose.

Professional Education Courses

In addition to the courses in the mathematics specialization component, students complete 22 semester hours of professional education courses in the department of Curriculum and Instruction. In these courses students are required to complete a series of readings and projects that focus on middle school instruction and adolescent psychology. The courses are in the areas of early adolescent psychology; reading development in the middle school; curriculum design; measurement and evaluation; and social, historical, and philosophical foundations of education.

Induction Year

Program graduates who start teaching the year following graduation are invited to participate in three follow-up sessions during that year. The rationale for these sessions is based on the well-documented need of beginning teachers for support and advice during their first year of teaching (Griffin et al., in press; Paulissen et al., 1985; Stone, 1985). The first of these sessions will be in early fall at the annual meeting of the Illinois Council of Teachers of Mathematics. Two other meetings will be planned later in the school year. These sessions will provide an opportunity for the program graduates to exchange views and experiences in teaching mathematics and participate in a workshop/seminar on an area/topic of identified need. A needs assessment form will be sent to the teachers for this purpose. The sessions will also provide an opportunity for the assessment of the program effectiveness in terms of its impact on the teachers' professional performance. The Department of Mathematics at ISU will sponsor the second and third meetings (see letter of support in Appendix B).

Program Admission and Graduation

The program is publicized through the office of Academic Advisement. Brochures containing a description of the program are distributed in early fall in large lecture freshman classes. In February an orientation meeting is held to inform interested students about the program and its admission requirements. Applications for admission into the program can be submitted at any time, but preferably during the applicant's freshman year. Admission requirements are as follows:

Admission Requirements

1. Three years of high school mathematics, including Algebra and Geometry.

2. Satisfactory performance on screening test.

3. Individual interview.

The screening test has been designed by program faculty to assess the applicant's understanding of concepts and proficiencies in arithmetic, high school algebra, and geometry. Applicants failing to perform successfully on this test are advised to take appropriate content courses before applying again. It has been the experience of the program faculty in working with preservice teachers that when they lack proficiency in basic mathematical content, they regard the content courses as "a last chance" to develop such proficiencies. Clearly the content courses have not been designed to provide that kind of remedial instruction. Moreover, the analysis of mathematical content intended in these courses assumes facility with the basic processes of arithmetic and with the language of algebra and geometry.

Each applicant is interviewed individually by a program faculty to determine professional goals, career awareness, and degree of commitment to a career in mathematics teaching. Each applicant is advised according to the results of this interview.

Certification of Graduates

The state of Illinois requires that teachers in departmentalized 6-8 grades satisfy the following requirements: 18 semester hours in mathematics, including 3 semester hours in the methods of teaching and 15 semester hours in mathematics to be selected from four of the following: mathematics content for elementary teachers, calculus, modern algebra or number theory, geometry, probability and statistics, computer science, and history of mathematics. Of the two institutions in the state of Illinois that have a middle school/junior high program, Illinois State University is the only one that offers a course on the methods of teaching mathematics at the middle school level..

Although there is no special middle school mathematics teaching certification at present in Illinois, the state does issue a special endorsement that accompanies the general certificate.

Project Resources

Project Staff/Consultants

The program staff consists of the program co-directors: Dr. Alba G. Thompson and Dr. Carol A. Thornton. Their major responsibilities have been to plan and coordinate the development, implementation, and evaluation of the program in addition to advising program students and teaching program courses. Additional staff include mathematicians and mathematics educators in the Mathematics Department at ISU who have been involved in the development and implementation of new courses. An external evaluator and an MSMP Advisory Board complete the project staff. Several mathematicians and mathematics educators have acted as consultants at different stages of the development effort.

Facilities

The Mathematics Department at Illinois State University is well equipped with three different facilities to support instruction. The department has a Mathematics Materials Center which is probably one of the best equipped in the nation. It has an extensive collection of school mathematics textbook series, instructional resources and equipment, teaching aids, and supplementary teacher references--not to mention a complete library of old and current mathematics education books and journals. The center is open daily through evening hours for the convenience of students and faculty.

In addition, the Department runs two Learning Assistance Centers for gifted and for remedial mathematics students. Both of these centers and all mathematics classes have access to the department's Microcomputer Laboratory, a two-room center which houses over 30 Apple microcomputers. Department faculty have access to additional microcomputers for course planning and development.

Funding Information

The development, implementation, and evaluation of the MSMP has been funded by the National Science Foundation under a five-year grant. The project is currently in its third year of funding.

Results

Final data on the overall effectiveness and viability of the program will be available in 1991. The project features a strong program evaluation design.

There are two components to the evaluation design: Component A deals with the assessment of the participants' knowledge of content and methods and their competence in applying that knowledge to instructional situations . Program faculty will be largely responsible for this component of the evaluation plan. Component B addresses the content validity of the program and its overall effectiveness. Assessment of the content validity will be based on input from program faculty, mathematicians and mathematics educators at other institutions, and selected middle school teachers. An external evaluator is responsible for the data collection and analyses of the overall program evaluation. The table below summarizes each of the program objectives and the evaluation techniques employed.

Component A

Participants' Knowledge & Competence

Objective	Evaluation Technique
Academic preparation in math content.	Paper screening--check application materials. Screening test. Performance in content courses--test grades, projects, assignments and written comments from faculty. Performance in content-related mini-lessons.
Knowledge of general methods.	Performance in methods courses--tests and assignments.Keep copies of participant-developed lessons, units, and activities.
Competence in microcomputer application in mathematics instruction.	Keep copies (on disk and hard copy) of all participant-produced programs. Performance in student-teaching task involving the use of microcomputers.
Competence in diagnosing learning problems in mathematics and in prescribing appropriate remediation procedures.	Keep running log of activities in Math Clinic. Performance in student-teaching project on diagnosis and remediation. Keep copies of participant-developed diagnostic instruments, records of analyses of youngsters' errors, remediation plans, and post assessment instruments.
Competence in designing and implementing enrichment lessons and activities.	Keep copies of enrichment lessons and materials produced. Performance in student-teaching task involving enrichment lesson. Micro-teaching demonstration.
Knowledge of trends and issues in mathematics education.	Survey of participants with written evaluative questionnaires.
Overall teaching performance. summary	Student-teaching observation records and evaluation form.

Component B
Content Validity and Program Impact

Objective	Evaluation Technique
Appropriateness of content in mathematics.	Input from program faculty,mathematicians & math educators at other institutions, Honors Project middle school teachers. Hired reviews by a mathematician and a mathematics educator (external).
Appropriateness of methods and pedagogical experiences	Input from program faculty, mathematics educators at other institutions, and Honors Project teachers. Hired reviews by two external mathematics educators.
Professional impact on participants.	Survey of participants with written evaluative questionnaire (twice during induction year). Participants' oral reports at follow-up sessions. Collect data on extent of microcomputer use in participants' classrooms. Collect observational data on a random sample of participants.

Dissemination

Detailed information about the model program will be available through a manual that will be produced by the project directors. The manual will include an overview of the program and description of its philosophy; detailed course syllabi including description of instructional approaches and sample activities and assignments; description of other program activities such as mini-lessons and other materials such as video lessons and case studies. Copies of the manual as well as of video lessons and case studies will be available upon request at cost of reproduction.